REMARKS

We appreciate the Examiner's indication that Claims 18-21, 24-29, 33, 34 and 38 are allowed, and that Claims 5-10, 13-17, 23, 31, 32, 35 and 36 would be allowable if rewritten in independent form. This however has not been done since the claims upon which they depend are also believed to be allowable.

Claims 2-4, 11, 12, 22, 30, 37 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,751,365 to Zhang et al. ("Zhang") in view of U.S. Patent 6,059,627 to Dean et al. ("Dean"). Further in view of U.S. Patent 5,597,457 to Craig et al. ("Craig"). The rejection is traversed in so far as it is applied to the claims as amended and set forth herein.

In the rejection the Examiner stated that "Zhang et al. disclose an e-field modulated bistable molecular mechanical device where in Fig. 1b, it is disclosed 2 elongated wires 12 and 14 with nanometer cross sections with coatings 20 and 22 respectively. Coatings 20 and 22 help in the modulation of the molecular mechanical device." We disagree with the Examiner's interpretation of Zhang. As clearly described in column 4, lines 22-46 and column 7, lines 6-21 of Zhang et al., the coatings 20 and 22 on wires 12 and 14 respectively are used to form the layer of molecules or molecular compounds 16 denoted R in Figures 1a and 1b. "Where the wires cross, R_s 18 is formed" column 7, line 17. Therefore the coatings 20 and 22, instead of helping in the modulation of the molecular mechanical device as opined by the Examiner, is actually the molecular layer that forms the molecular switch that is activated by electric field. The operation of the molecular switch is described in more detail in column 12, line 61 through column 13, line 10 and in column 14, line 1 through line 25. As clearly described in the above-

referenced and other sections, Zhang's device employs molecules that form a rotatable middle segment (rotor) that has a large dipole moment and that links two other portions of the molecule that are immobilized (stators). Under the influence of an applied electric field, the vector dipole moment of the rotor will attempt to align parallel to the direction of the external field. However due to inter and/or intra-molecular forces, such as hydrogen bonding or dipole-dipole interactions as well as steric repulsions, the rotor is stabilized in particular orientations with respect to the stators. Therefore a large field is required to cause the rotor to unlatch from its initial orientation and rotate with respect to the stators, if the direction of the flight field is opposite to that of the dipole of the rotor. The operation of the molecular system of Zhang et al. is also summarized in the abstract of the Zhang patent.

From the above, it is believed that Zhang's device relies upon the rotation of the rotor relative to the stators in order to accomplish the molecular switching function. In contrast, the invention of Claim 1 does not require any such motion. Claim 1 has been amended to clarify that when an electric field is applied to the elongated structure in a direction transverse to the structure and electronic energy band structure of the elongated structure is modulated without substantially moving any portion of the elongated structure. That this is the case is clear from the description of the various embodiments in the specification of the present application. This is demonstrated, for example, in Figs. 1b, 2, 3a, 3b, 4 and the accompanying description in the specification.

Thus as amended, Claim 1 differs radically from the operation of Zhang. The operation of the device in Claim 1 does not require any substantial or significant movement of any portion of the elongated structure. In contrast, the entire operation

principle of Zhang relies on the relative rotational motion of the rotor portions of molecules relative to the stator portions of the molecules.

Dean and Craig are believed to be non-analogous art and should therefore be removed as references. Even assuming arguendo that they may be considered, these two references likewise fail to remedy the above described deficiencies of Zhang so that the three references either individually or in combination fail to teach or suggest Claim 3.

A reference is non-analogous art if it is not within the field of endeavor of the invention of the rejected claim and not reasonably pertinent to the particular problem with which the inventors are involved. In re Deminski, 230 U.S.P.Q. 215 at 315 (Fed. Cir. 1986). Based on the arguments below, it is believed that Dean and Craig should be withdrawn as a reference since they are non-analogous art. For this and other reasons as explained below, it is respectfully requested that this rejection be withdrawn.

Dean relate to field emission devices in order to achieve uniform emission currents from groups of electron emitters. Dean, see column 1, lines 11-26. The invention of rejected Claim 3, on the other hand, relates to the application of electric field to an elongated structure with nanometer cross-sectional dimensions so as to modulate the electronic energy band structure of the elongated structure. Dean is therefore clearly outside the field of endeavor of rejected Claim 3. The particular problem with which the inventors are involved in rejected Claim 3 is to be able to modulate the electronic energy band structure of the elongated structure of nanometer cross-sectional dimensions without moving substantially any portion of the structure. Dean, on the other hand, is concerned with achieving uniform emission currents among groups of electron emitters and is therefore not reasonably pertinent to the particular problem with which the inventors are involved with respect to rejected Claim 3. Dean is therefore non-analogous art with respect to Claim 3 and should be removed as a reference. Claim 22 relates to the

application of an electric field across an elongated structure of nanometer cross-sectional dimensions to cause a shift in optical energy absorption wavelength characteristics. Dean is therefore clearly outside the field of endeavor of rejected Claim 22 and further is not reasonably pertinent to the particular problem with which the inventors are involved which is to cause a shift in optical energy absorption wavelength characteristics of the nanometer scale elongated structure without substantially moving any portion of the structure. Dean therefore should also be removed as a reference with respect to Claim 22.

For reasons similar to those above for claim 3, Dean is likewise outside the field of endeavor of rejected Claim 30. In claim 30, the particular problem with which the inventors are involved is to be able to cause an electrical potential gradient to develop around a perimeter of the elongated structure so as modulate the electronic energy band structure of the elongated structure of nanometer cross-sectional dimensions. Dean, on the other hand, is concerned with achieving uniform emission currents among groups of electron emitters and is therefore not reasonably pertinent to the particular problem with which the inventors are involved with respect to rejected Claim 30. Dean is therefore non-analogous art with respect to Claim 30 and should be removed as a reference.

Craig relates to a method for forming synthetic crystals of proteins in a carrier fluid by the use of dipole moments of protein macro molecules that self-align in a layer adjacent to an electrode. Craig is therefore clearly outside the field of endeavor of rejected Claims 3, 22 and 30 and is further not reasonably pertinent to the particular problem with which the inventors are involved with respect to these three claims. Craig therefore should also be removed as a reference.

Even assuming arguendo that both Dean and Craig may be considered, it is believed that the Examiner has failed to present a prima facie case of obviousness. In particular, there appears to be no reason or motivation from making the combination now urged by the Examiner. Thus the electrical potentials applied to the electrodes 720 and 780 in Fig. 8 of Dean are for the purpose of controlling the paths of electrons emitted by field emitters 775, reasons which have nothing to do with applying an electric field to molecules such as those in Zhang in order to reorient portions of molecules (rotors) relative to other portions of the molecule. The Examiner has simply failed to present any reason or motivation for combining Dean with Zhang. In addition, the components in field emission devices are typically orders of magnitude larger than nanoscale and the Examiner has failed to explain how the field emitter device of Dean which is orders of magnitude larger than those of Zhang can be combined with Zhang's device.

Even though Craig teaches the application of electric field of a large amplitude such as 3MV/m, the electric field is applied to a line protein molecules in liquid suspension into a two-dimensional seed letters for subsequent self-assembly of three-dimensional protein crystals. Column 5, lines 33-36. Thus the reason for Craig's use of an electric field is radically different from and has nothing to do with the application of electric field to activate molecular switches as in Zhang in order to change the electronic or optical characteristics of a molecular layer. Again the Examiner has simply failed to present any reason or motivation of combining this particular feature of Craig with Zhang.

The Examiner's position appears to be contrary to the court's ruling in *In re Sang Su Lee*, 277 F.3d 1338, 61 U.S.P.Q.2d 1430 (Fed. Cir. Jan. 2002). In such case, the Federal Circuit, quoted *In re Dembiczak*, 175 F.3d 994, 999, 50 U.S.P.Q.2d 1614, 1617

(Fed. Cir. 1999) as follows: "Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references." The Federal Circuit went on to state that "The need for specificity pervades this authority . . . . The Examiner's conclusory statements . . . do not adequately address the issue of motivation to combine. This factual question of motivation is material to patentability, and could not be resolved on subjective belief and unknown authority."

The combination urged by the examiner is therefore based only on subjective belief and unknown authority. As pointed out by the Federal Circuit in the *In re Sang Su Lee* case, under the Administrative Procedure Act, the Patent Office is required to develop an evidentiary basis for its findings and its omission is both legal error and arbitrary agency action. Therefore, the Examiner has failed to provide adequate evidentiary basis for its factual findings and failed to prove a *prima facie* case of obviousness with respect to the rejected claims.

Based on the above, it is believed that Claims 3, 22 and 30 (explained further below in the case of claim 30) are allowable over all art of record, including Zhang, Dean and Craig. Claims 2, 4, 11, 12, 37 and 39 are believed to be allowable since they depend from allowable claims. They are further believed to be allowable since they add limitations which are not taught or suggested by the art of record. Thus Claim 11 adds the limitation that the elongated structure includes at least one semiconducting nanotube or nanowire. As noted above, the only conceivable corresponding elements in Zhang to the elongated structure of Claim 3 are the coatings 20 and 22 on the elongated wires 12 and 14. Therefore Zhang fails to teach or suggest the use of a nanotube or nanowire as the switching element to which the electric field (such as by means of nanotubes or nanowires 22 of Fig. 1b of the present application) is applied to accomplish the switching

function. Dean and Craig fail to remedy the above deficiencies of Zhang. Claim 11 is believed to be patentable over all art of record, including Zhang, Dean and Craig.

The examiner has failed to address the limitation of claim 30 of "a device that causes an electrical potential gradient to develop around a perimeter of the elongated structure" and thus failed to provide a prima facie case of obviousness with respect to claim 30, and for that reason, claim 30 is believed to be allowable. As noted above, the only structure in Zhang relied on by the Examiner in the rejection of Claim 30 that can conceivably be deemed to be similar to the elongated structure of Claim 30 are the coatings 20 and 22. Zhang, however, fails to teach or suggest a device that causes an electrical potential gradient that develops around a perimeter of coatings 20 and 22. Instead, Zhang describes effect of the application of the electric field on rotational motion of certain portions of the molecule relative to the other portions. Zhang therefore fails to teach or suggest the above-described feature of Claim 30. As discussed above, Dean and Craig are believed to be non-analogous art with respect to Claim 30 and should be removed as references. Even if they may be considered with respect to Claim 30, there is again no reason or motivation for combining the three references for reasons similar to those explained above. Even if they may be combined, the combination would still fail to teach or suggest the above-described feature of Claim 30 of a device causing an electric potential gradient to develop around a perimeter of the elongated structure.

New Claims 40-60 have been added to more adequately cover the various aspects of the invention. For reasons similar to those explained above, these new claims are likewise believed to be allowable.

Claims 2-60 are presently pending in the application. Reconsideration of the rejections is respectfully requested and an early indication of the allowability of all the claims is earnestly solicited.

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I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope address to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on February 1, 2005.

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Respectfully submitted,

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2/1/05
Date